

Amended Claims

The amended claims are directed to a "method for packaging a semiconductor die to form a semiconductor package". The method includes the step of "providing a leadframe", and "providing a cyanoacrylate adhesive material formulated to cure in less than about 60 seconds at a temperature of about 20°C to 30°C and at an ambient atmosphere". The adhesive material is initially applied to the die 10 (Figure 1A) or to the leadframe 14 (Figure 1A). For a leadframe 14 having a mounting paddle 12 (Figure 1B) the adhesive material can be applied to the mounting paddle 12. For a lead-on-chip leadframe 14A (Figure 5), the adhesive material can be applied to leadfingers 38 (Figure 5), that are configured to support the die 10A (Figure 5).

Following the adhesive "applying" step, a "placing" step is performed wherein the die is placed "on the leadframe with the adhesive material in contact with the die, and the leadframe to form an adhesive layer therebetween". The adhesive layer 20 (Figure 1B) is then subjected to a "curing" step "at the temperature and at the ambient atmosphere in less than 60 seconds to bond the die to the leadframe".

The method of the invention can also be performed with an "anaerobic acrylic adhesive" rather than a "cyanoacrylate adhesive" (page 9, lines 9-16 of the specification). Independent claims 21 and 42 define the method with an "anaerobic acrylic adhesive".

Rejections Under 35 USC §103

In response to the rejections, the claims have been amended to emphasize features of the method which "taken as a whole" are unobvious over the prior art. A first feature is that the method attaches a "semiconductor die" to a leadframe to form a "semiconductor package". Admittedly, epoxies and other adhesives are well known in the art for attaching dice to leadframes to form semiconductor packages. However, instant curing "cyanoacrylate adhesives" and "anaerobic

acrylic adhesive" have not been heretofore been used in the fabrication of semiconductor packages. A process advantage is provided because heat curing is eliminated. In addition, the completed package is improved because a low thermal budget has been maintained.

The primary reference, DiLeo et al., is directed to a "method of fabricating a microelectronic device". The method attaches a "light emitting diode 10", rather than a "semiconductor die" to a leadframe 20. (Although the light emitting diode of DiLeo et al. includes a semiconductor material, it is not a semiconductor die, as in the present claims. In addition, the packaged LED assembly 50 (Figure 4) of DiLeo is not a semiconductor package, as in the present claims.)

Independent claim 1 has also been amended to recite the additional step of "providing a filler in the adhesive material selected to improve a characteristic of the adhesive material in the package". Antecedent basis for this recitation is contained on page 8, lines 26-33 of the specification:

"In general, the "410" and "416" cyanoacrylate adhesives are not formulated for electronics packaging. Accordingly, they must be modified with various other constituents and fillers to improve the thermal conductivity, mechanical strength, electrical conductivity, dielectric strength, moisture resistivity, thermostability, or other characteristics of the adhesive layer 20 (Figure 1B) for a particular electronics packaging application."

Independent claims 6 and 42 recite the specific characteristics that the filler improves in the semiconductor package. Antecedent basis for these recitations is contained in the above quoted passage. Independent claim 12 recites the step of providing "an electrically insulating filler configured to increase a dielectric strength of the adhesive material to inhibit cross talk between the lead fingers in the package". Antecedent basis for this recitation is contained on page 10, line 36 to page 11, line 3 of the

specification. Independent claim 15 and 21 recites specific materials for the filler. Antecedent basis for these recitations is contained on page 8, line 34 to page 9, line 3 of the specification.

(DiLeo teaches an unfilled adhesive, and specifically "teaches away" from fillers in the adhesive (column 2, lines 34-43). Prior art that "teaches away" cannot be used to support an obviousness rejection, U.S. v. Adams, 383 U.S. 39, 148 USPQ 479 (1966).)

Nishino et al. and Litke were cited as teaching the incorporation of a filler in a cyanoacrylate adhesive. Gruber et al. was cited as teaching the incorporation of a filler in an acrylate based anaerobic adhesive. However, there is no motivation for the proposed combination of DiLeo et al. and any of the secondary references, as DiLeo et al. specifically teaches away from fillers. (As held in ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F. 2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984), there must be some teaching, suggestion or incentive in the reference, or in the prior art, which supports the proposed combination.)

In addition, the concept of providing fillers in "cyanoacrylate adhesives" and "anaerobic acrylic adhesives" to improve the characteristics of the adhesive for a semiconductor package, is not suggested by the prior art.

Nishino et al., Mikuni et al. and O'Sullivan were cited as teaching cyanoacrylate adhesive compositions. Burnett et al. was cited as teaching an acrylate monomer adhesive. Admittedly these adhesive compositions are known in the art. However, instant curing compositions have not heretofore been adapted and used in semiconductor packaging. The present method can be performed using commercially available compositions, but they must be modified with fillers as stated above.

Further, there would be no incentive to replace the adhesive in DiLeo et al. with a cyanoacrylate adhesive or an anaerobic acrylic adhesive of a secondary reference.

Although DiLeo et al. suggests a room temperature curing adhesive at column 3, line 36, this is not a cyanoacrylate adhesive, or an anaerobic acrylic adhesive as presently claimed. In addition, there are no teachings in the reference, or the prior art in general, that would enable a skilled artisan to use a cyanoacrylate adhesive, or an anaerobic acrylic adhesive, in a semiconductor package as presently claimed.

Conclusion

In view of the amendments and arguments, favorable consideration and allowance of amended claims 1-22, and 40-44 is requested. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

DATED this 17th day of February, 2000.

Respectfully submitted:



STEPHEN A. GRATTON
Registration No. 28,418
Attorney for Applicants

2764 S. Braun Way
Lakewood, CO 80228
Telephone: (303) 989-6353
FAX (303) 989-6538

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class mail in an envelope addressed to: Assistant Commissioner of Patents, BOX AMENDMENT (NON FEE), Washington, D.C. on this 17th day of February, 2000.

February 17, 2000
Date of Signature



Stephen A. Gratton
Attorney for Applicants